Face Retrieval System by Similarity of Impression Based on Hair Attribute

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(a) (b)

Figure 1: *Query image (a), retrieval results (b). Although this Japanese idol changes her hair style and colors many times, we were able to find many bob-cut and brown hair images. We used the database which includes 246 images.*

1. Introduction

There is a great demand for human image retrieval on the Web. On searching person's images, not only whether he or she is the person you are looking for, but also the appearance of the person is an important factor. Since current image search systems such as Google Image Search are based on textual data, they are useful when we want to look over a particular person's face, but they cannot consider the appearance or the impression of the person sufficiently. Most of the images on the Web are not annotated because it is often difficult to describe the human appearances in words.

While there are many factors, hair is especially an important feature of human appearance. According to Davis et al. [1981], hair appearance is the most important feature in the recognition of familiar people. Therefore, in this paper we present a human image retrieval system based on hair appearance features. We propose novel hair appearance features which affects the impression of the person.

2. Our Method

In our system, we retrieve images from database based on the hair appearance similarity to the query image. The system consists of three parts. First, we normalize the face image and detect the hair region automatically. Then, we calculate the hair appearance features in the hair region. Finally, we retrieve images based on the similarity between the query image and the images in the database.

In the first step, we normalize the image and detect the hair region. First, we detect facial feature points. Using the feature points of the eyes, we normalize face size and angle by affine transformation. This step makes the hair representation comparable among the images. Then, by using the facial feature points, we detect an approximate skin and hair region. Finally, we apply graph-cuts segmentation using these regions as background and foreground seeds. This step allows us to detect the hair region automatically.

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In the second step, we calculate three hair appearance features, which represent hair style, hair color, and hair texture, respectively. Hair style feature consists of hair length and hair volume. This feature allows the system to recognize many hair styles such as bob-cuts, pigtails, normal long hair, etc. To calculate the hair style feature, we divide the hair region into 20×20 equal patches. Then, we count the number of hair pixels in their individual patches and this represents the hair style feature. Hair color feature is represented by means of color histogram in the hair region. We quantize RGB color into 1000 colors. Because we use the color histogram, it is able to represent hair color properly even if the hair has more than one color. Hair texture feature allows the system to recognize curly hairs and straight hairs. To calculate the hair texture feature, we first apply a 9-direction Gabor filter to the image. Then, we divide the filtered images to 20×20 equal patches. Finally, we add up the edge strength in individual patches, which represents the hair texture feature. We divided into patches because hair direction usually varies from part to part.

In the last step, we calculate similarities between the hair features of the query images and those of the images in the database. Thereby, the images which have the similarities higher than the given threshold values are shown in the retrieval result. Since the threshold value depends on user's request, we created an interactive image retrieval system by changing the threshold values.

3. Retrieval Results and Conclusions

Figure 1 shows the retrieval result. Most of the images in the result have similar hair style and color to the query image. Most of the images are bob-cuts and have straight bangs. Furthermore, they have curly hair tips as well as the query image. Therefore, in our system we are able to search images that matches to the hair features of the query image. Especially, the images on the top row in Figure 1 have similar impression to the query image.

In this paper, we presented an interactive image retrieval system based on the hair appearance features. Moreover, we have to consider other human appearance features which affects the impression of the person.

References

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